A Demonstration of Submerged Aquatic Vegetation/Limerock Treatment System Technology for Removing Phosphorus From Everglades Agricultural Area Waters
Third Monthly Report

Prepared for:
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Introduction

On February 12, 1998, the District contracted with DB Environmental Laboratories, Inc. (DBEL) to design, construct, operate, and evaluate a 13-month, tank-scale (i.e., "mesocosm") demonstration of SAV/ Limerock Treatment System technology for reducing P discharge from EAA waters. The objectives of this project are twofold. First, obtain the performance data and operational experience necessary to evaluate the technical, economic, and environmental feasibility of using SAV/Limerock technology for P removal at either the watershed basin- or farm-scale. Second, guide the design and operation of a larger, field-scale SAV/Limerock demonstration project should the District choose to investigate this technology further. This report summarizes progress during the seventh month (project weeks 28-31) by DB Environmental Laboratories, Inc. (DBEL) on the Submerged Aquatic Vegetation/Limerock (SAV/LR) demonstration project.

Synopsis of Progress to Date

North Project Site

All experiments at the North Supplemental Technology Site have been started and are proceeding according to the attached schedule (Fig. 1). During early September, we performed the initial sampling of ancillary parameters (nitrogen species, etc.) and we also conducted our first diel sampling event for the Task 4C experiment.

We performed our first submerged macrophyte harvest for Task 4E during mid-September. To date, the "non-harvested" and "harvested' treatments have performed similarly with respect to TP and SRP removal (Fig. 2). In the depth study (Task 4F), we are beginning to see some P removal performance differences among the three water depths (Fig. 3).

Our initial data for Task 4G, the limerock type and size experiment, is demonstrating that the caprock obtained from the Palm Beach Aggregate quarry is providing better P removal than either the baserock from this site, or the limerock obtained from a borrow pit on State Road 80 (Table 1). The baserock is considered of poor quality because it has a high native P content, and the SR 80 rock is assumed to be of poor quality because of high Mg and low Si contents. Among the three caprock sizes (0.25 - 0.5"; 0.5 - 1.0"; 1.0 - 2.0") being tested, the smallest size fraction is providing slightly better P removal than the two larger sizes (Table 1). The 0.5 - 1.0" caprock is the material being used in experiments 4C (North site) and 4D (South site).

South Project Site

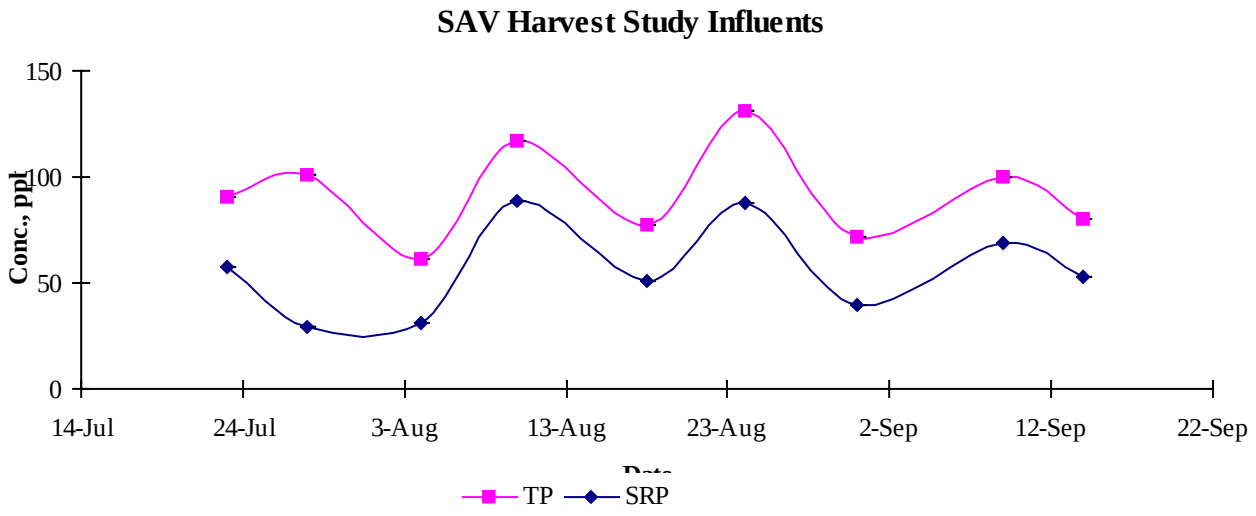
All mesocosms at the South Site are performing well. The plant community in the shallow (10 cm deep), low velocity raceways has been dynamic, with fluctuating densities of submerged macrophytes and periphyton. During the last two sampling events (9/10 and 9/15/98), system effluents have dropped below 10 ppb (averaging 9 and 8 ppb, respectively).

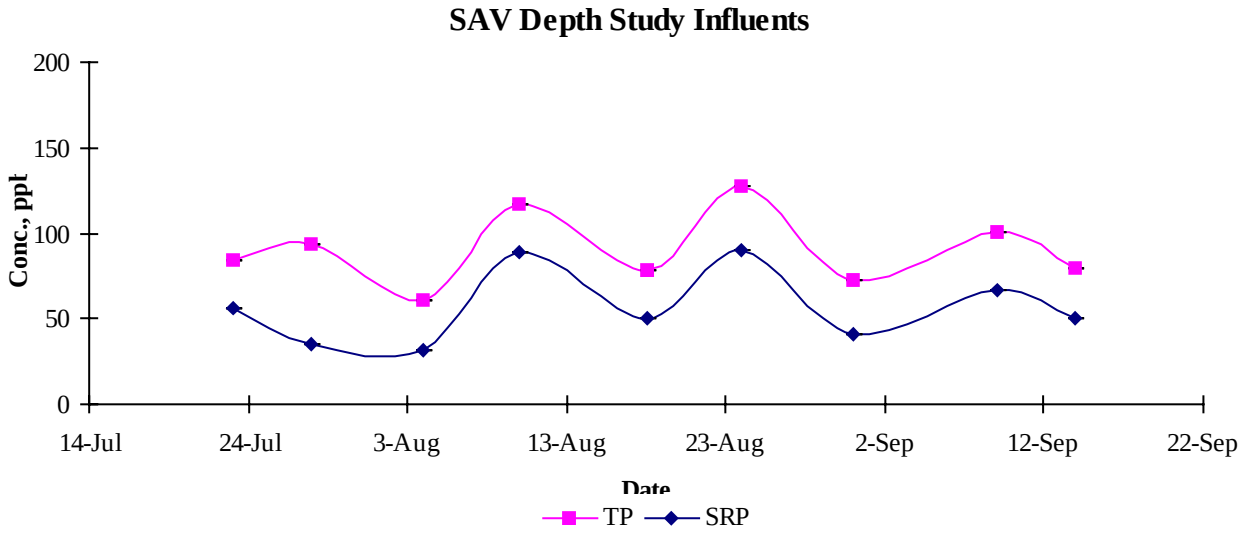
Vegetation in the deeper (0.5 m), low velocity mesocosms has appeared more stable, and the effluent P levels have been slightly higher (averaging 12 ppb on 9/10 and 11 ppb on 9/15) than in the shallower systems. Sampling for ancillary parameters (e.g., N species) was performed in both the shallow and deep low velocity systems during early September. A diel sampling event was scheduled in these mesocosms for the week of 9/21, but was canceled due to Hurricane Georges.

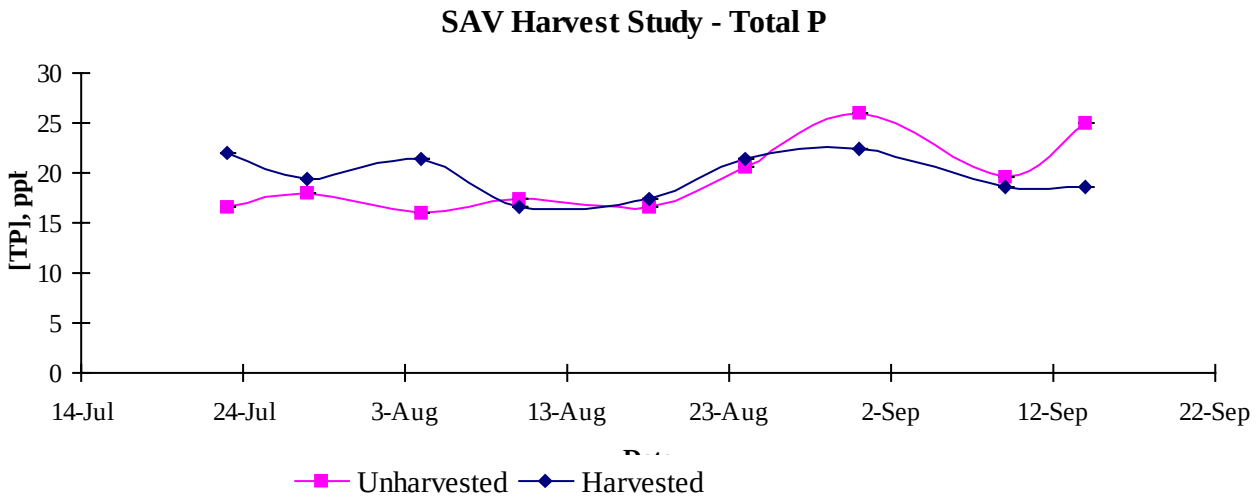
In late August we initiated a program of biomass harvesting in the high velocity, shallow (1 cm) mesocosms. The periphyton that grows on the culture surface is harvested at approximately 10-14 day intervals, and subsamples are collected for analysis of dry matter content and elemental (C, N and P) composition. These data will be used to calculate P mass removal rates, and to compare P removal in recoverable biomass with the observed P removal from the influent water.

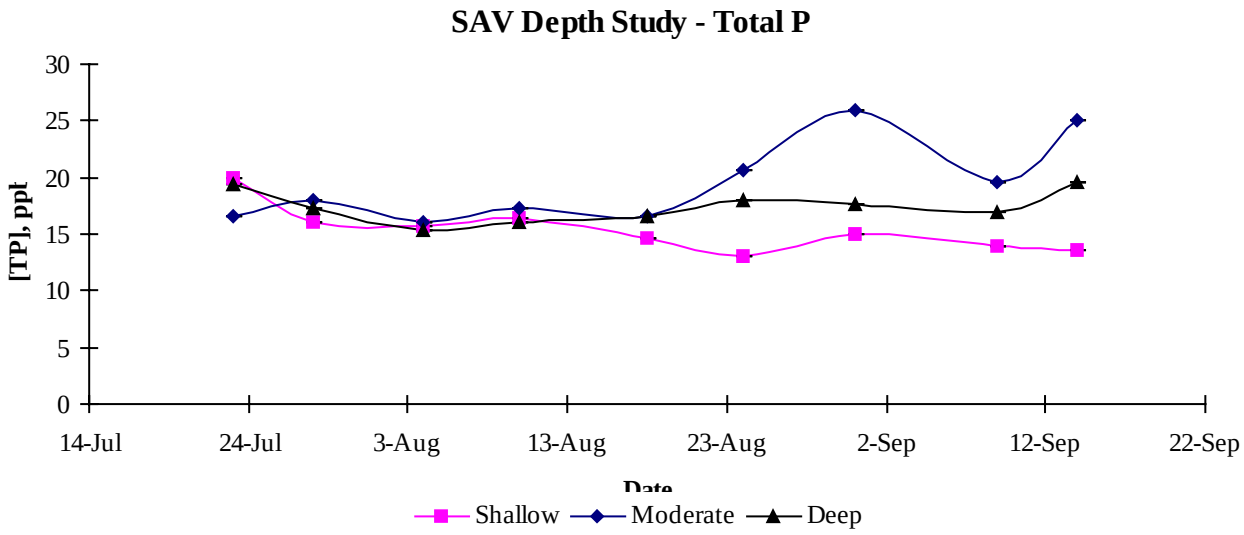
Table 1. Phosphorus removal performance of three limerock types (each 0.5 - 1.0” size), and of three size fractions of one limerock type. Data collected during the period Sept. 4 - 14, 1998.

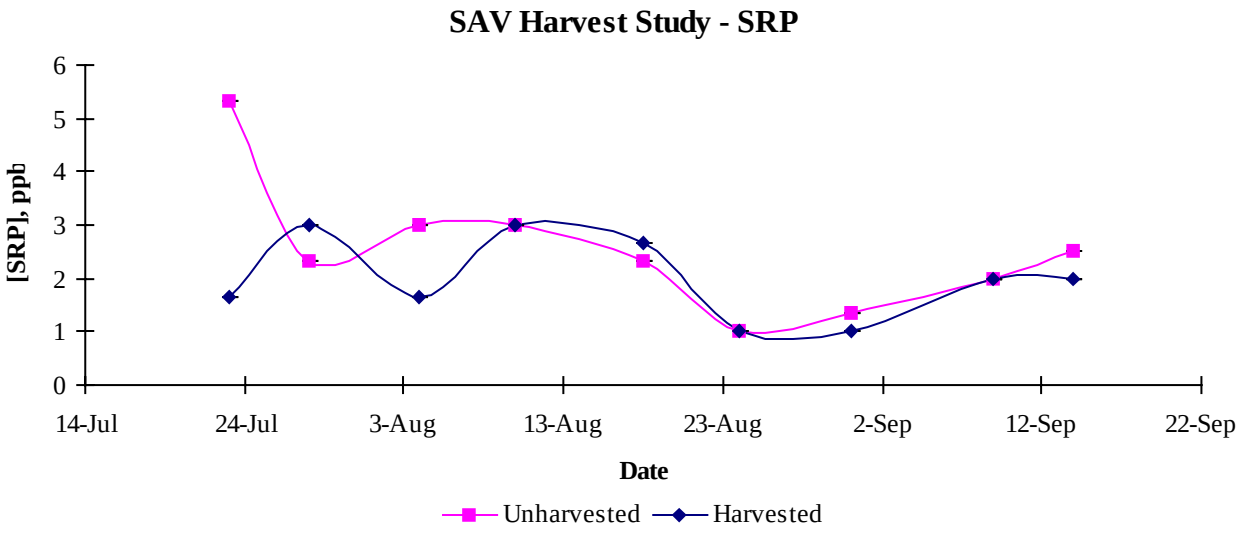
	SRP (mg/L)		**TP (mg/L)**	
	mean	*range*	*mean*	*range*
Influent	**0.018**	0.009 - 0.023	**0.044**	0.033-0.042
PBA caprock (0.25-0.5”)	**0.012**	0.005 - 0.019	**0.035**	0.029 - 0.040
PBA caprock (0.5 - 1.0”)	**0.016**	0.008 - 0.022	**0.037**	0.032 - 0.045
PBA caprock (1.0 - 2.0”)	**0.015**	0.008 - 0.021	**0.037**	0.032 - 0.044
PBA baserock (0.5 - 1.0”)	**0.014**	0.006 - 0.021	**0.043**	0.034 - 0.058
SR80 Limerock (0.5 - 1.0”)	**0.016**	0.009 - 0.022	**0.041**	0.034 - 0.055

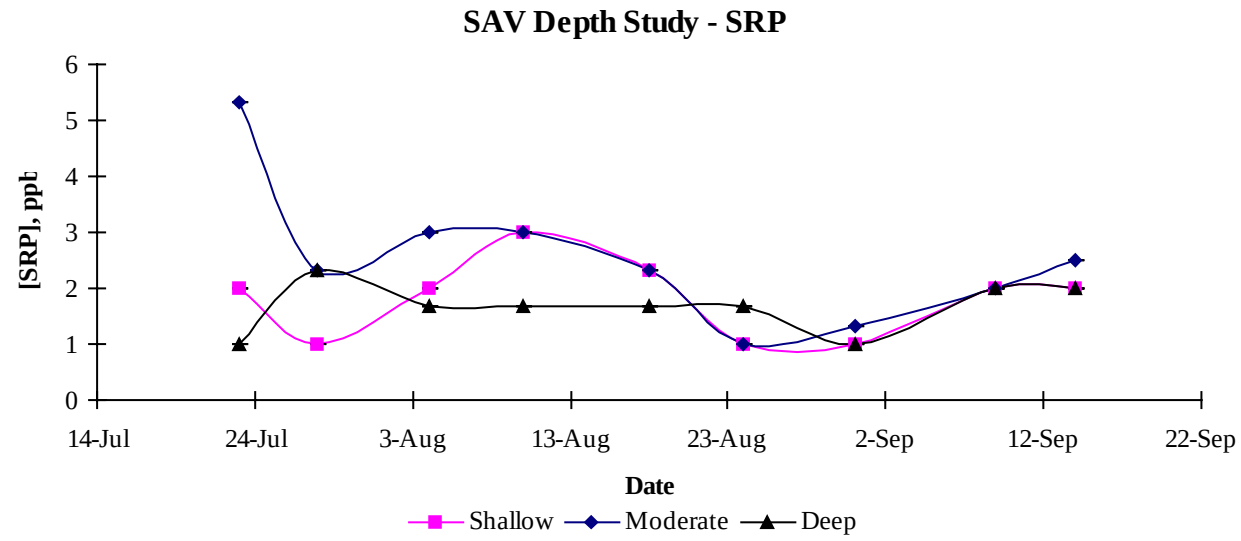

SAV Harvest Study Influents
150
100
50
0
Conc., ppb
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
22-Sep
TP
SRP


SAV Depth Study Influents
200
150
100
50
0
Conc., ppb
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
22-Sep
Date
TP
SRP

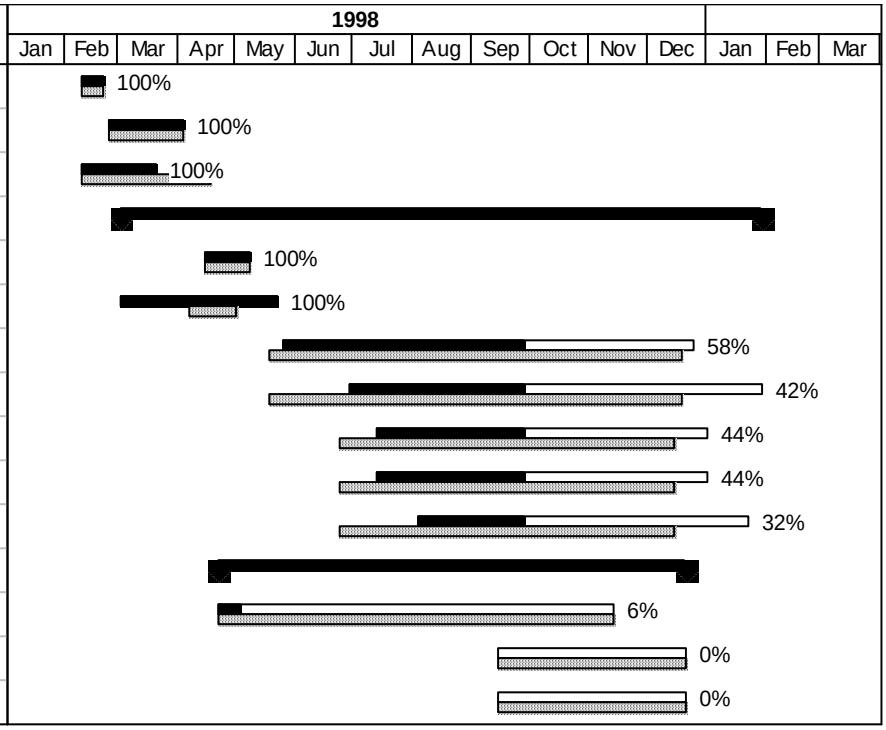

SAV Harvest Study - Total P
[TP], ppt
30
25
20
15
10
5
0
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
22-Sep
Unharvested
Harvested


SAV Depth Study - Total P
[TP], ppt
30
25
20
15
10
5
0
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
22-Sep
Date
Shallow
Moderate
Deep


SAV Harvest Study - SRP
[SRP], ppb
0
1
2
3
4
5
6
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
22-Sep
Date
Unharvested
Harvested


SAV Depth Study - SRP
[SRP], ppb
0
1
2
3
4
5
6
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
22-Sep
Date
Shallow
Moderate
Deep

ID	Task Name
1	Task 1: Prelim. Project Work Plan
2	Task 2: Final Project Work Plan
3	Task 3: Project QAPP
4	**Task 4: Design and Operation of SAV/LR System**
5	4A: Limerock Characterization
6	4B: Demonstration Facility Construction
7	4C: HRT Study
8	4D: Low Nutrient Water Study
9	4E: Plant Harvest Study
10	4F: Plant Depth Study
11	4G: Limerock Comp. and Size Study
12	**Task 5: Technology Assessment**
13	5A: Field Observation of ENR SAV
14	5B: Tech. and Environmental Assessments
15	5C: Economic Analysis



Legen

Proposed

Adjusted

Task Progress

Task Summary

Figure 1. SAV/Limerock Project Schedule

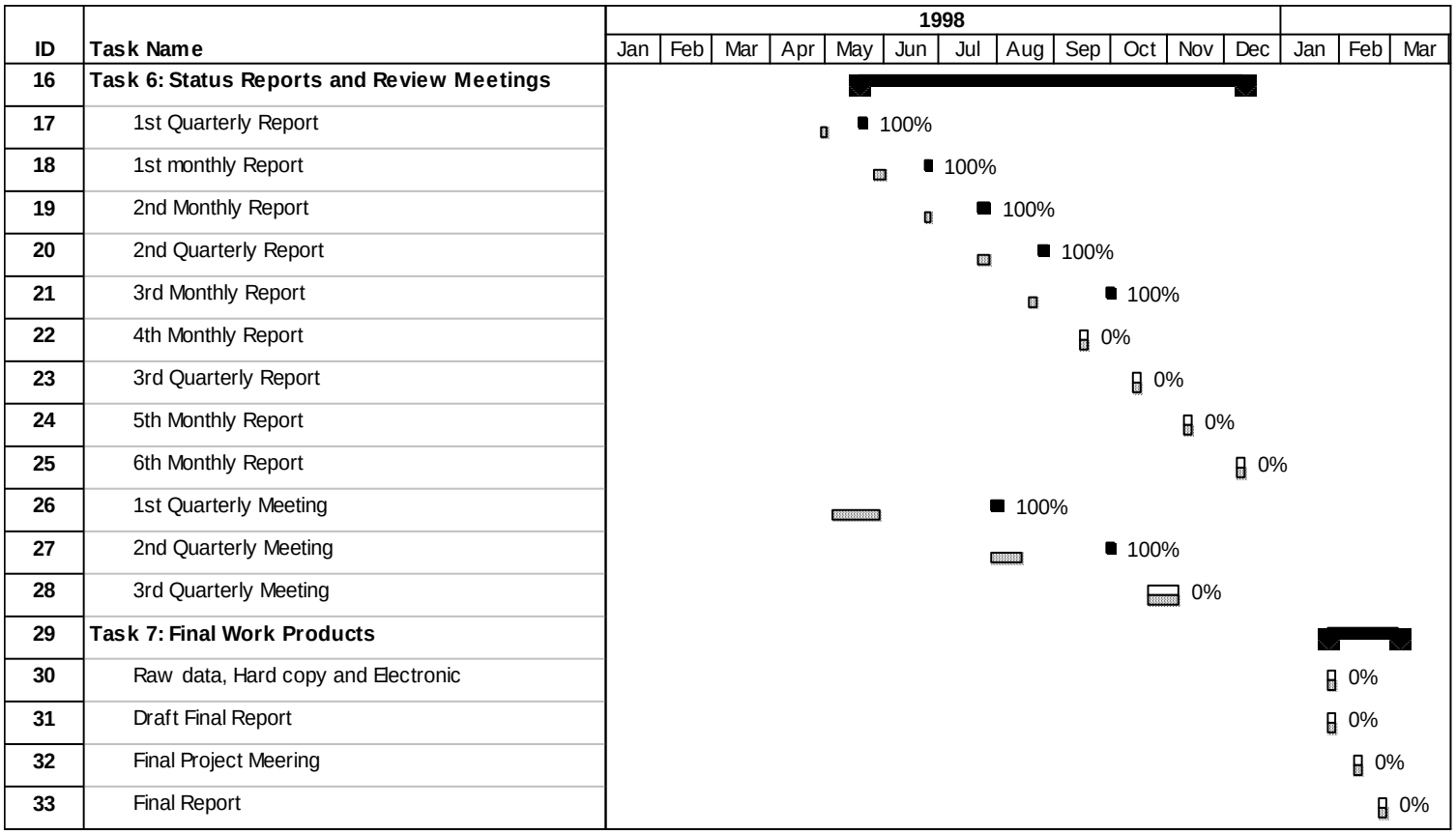


Figure 1 (cont.) SAV/Limerock Project Schedule